

CLAIMS

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3 1. A remote, non-contact system for detecting a defect in a railroad wheel,
4 said system comprising:

5 a remote means, located at a first specified location in the environment
6 surrounding said wheel, for generating in a non-contact manner in said wheel an
7 ultrasonic wave having a specified wavefront, said ultrasonic wave having a direct
8 portion and reflected and transmitted portions if said direct portion encounters a
9 defect in said wheel,

10 a non-contact means, located at a second specified location in said
11 environment, for sensing from said wheel the acoustic signal emanating from said
12 wheel that results from said ultrasonic wave traveling through said wheel,

13 a signal processing means, responsive to said sensed acoustic signal, capable
14 of distinguishing whether said sensed signal has a component that indicates the
15 existence of a portion chosen from the group consisting of reflected and transmitted
16 portions in said ultrasonic wave.

17 wherein the presence of said component in said acoustic signal indicates the
18 existence of a defect in said railroad wheel.

19 2. A defect detection system as recited in Claim 1, wherein said specified
20 wavefront is chosen so as to yield said wave having frequencies that match the
21 frequency sensing capabilities of said non-contact, sensing means.

22 3. A defect detection system as recited in Claim 1, wherein said ultrasonic
23 wave generating means is modulated so as to yield said wave having frequencies that
24 match the frequency sensing capabilities of said non-contact, sensing means.

25 4. A defect detection system as recited in Claim 2, wherein said ultrasonic
26 wave generating means is modulatable so as to yield said wave having frequencies
27 that match the frequency sensing capabilities of said non-contact, sensing means.

28 5. A defect detection system as recited in Claim 1, wherein said defect is of a
29 specified type and said specified wavefront is chosen so as to enhance the sensitivity
30 of said non-contact, sensing means to said specified type of defect.

1 6. A defect detection system as recited in Claim 1, wherein when said defect
2 is a surface defect, said specified wavefront is generated with a formed laser source.

3 7. A remote, non-contact method for detecting a defect in a railroad wheel,
4 said method comprising the steps of:

5 generating, in a non-contact manner in said railroad wheel an ultrasonic wave
6 having a specified wavefront, said generated ultrasonic wave having a direct portion
7 and reflected and transmitted portions if said direct portion encounters a defect in said
8 wheel,

9 sensing from said railroad wheel the acoustic signal in the environment
10 surrounding said wheel that emanates from said wheel as a result of said ultrasonic
11 wave traveling through said wheel,

12 processing said sensed acoustic signal to determine whether said sensed signal
13 has a component that indicates the existence of a portion chosen from the group
14 consisting of reflected and transmitted portions in said ultrasonic wave,

15 wherein the presence of said component in said acoustic signal indicates the
16 existence of a defect in said railroad wheel.

17 8. A defect detection method as recited in Claim 7, further comprising the
18 step of choosing said specified wavefront so as to yield said ultrasonic wave having
19 frequencies that match the frequency sensing capabilities encountered in said sensing
20 step.

21 9. A defect detection method as recited in Claim 7, further comprising the
22 step of choosing the frequency of said ultrasonic wave so that said chosen frequency
23 is compatible with the frequency sensing capabilities encountered in said sensing
24 step.

25 10. A defect detection method as recited in Claim 8, further comprising the
26 step of choosing the frequency of said ultrasonic wave so that said chosen frequency
27 is compatible with the frequency sensing capabilities encountered in said sensing
28 step.

29 11. A defect detection method as recited in Claim 7, wherein said defect is of
30 a specified type and said specified wavefront is chosen so as to enhance the signal
31 sensitivity encountered in said sensing step to said specified type of defect.

1 12. A remote, non-contact system for detecting a defect in a railroad wheel,
2 said system comprising:

3 a pulsed, laser light source, located at a first specified location in the
4 environment surrounding said wheel, for generating in said wheel an ultrasonic wave,
5 said ultrasonic wave having a direct portion and reflected and transmitted portions if
6 said direct portion encounters a defect in said wheel,

7 an optical component in the path of the light from said light source for
8 forming said light into a specified illumination pattern so that said generated
9 ultrasonic wave has a specified wavefront,

10 an air-coupled transducer, located at a second specified location in said
11 environment, for sensing from said wheel the acoustic signal emanating from said
12 wheel that results from said ultrasonic wave traveling through said wheel,

13 a signal processor, responsive to said sensed acoustic signal, capable of
14 distinguishing whether said sensed signal has a component that indicates the
15 existence of a reflected portion in said ultrasonic wave,

16 wherein the presence of said component in said acoustic signal indicates the
17 existence of a defect in said railroad wheel.

18 13. A defect detection system as recited in Claim 12, wherein said specified
19 wavefront is chosen so as to yield said wave having frequencies that match the
20 frequency sensing capabilities of said transducer.

21 14. A defect detection system as recited in Claim 12, wherein said pulsed
22 laser is modulated so as to yield said wave having frequencies that match the
23 frequency sensing capabilities of said transducer.

24 15. A defect detection system as recited in Claim 13, wherein said pulsed
25 laser is modulated so as to yield said wave having frequencies that match the
26 frequency sensing capabilities of said transducer.

27 16. A defect detection system as recited in Claim 12, wherein said defect is of
28 a specified type and said specified wavefront is chosen so as to enhance the
29 sensitivity of said transducer to said specified type of defect.

1 17. A defect detection system as recited in Claim 12, wherein said defect is a
2 surface defect in a railroad wheel, and said controlled wavefront is generated with a
3 formed laser source.
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